IN THE CLAIMS

Please amend the claims as following:

1. (Previously Presented) A computer-implemented method for constructing a representation of a first system for use with a computer graphical user interface, said first system represented by a first finite element mesh, a second system being within said first system, said second system represented by a second finite element mesh, the method comprising:
constructing said first finite element mesh having a plurality of n-dimensional simplices corresponding to said first system;
defining a surface bounding said second system;
identifying a subset of the plurality of n-dimensional simplices of said first finite element mesh that are intersected by said surface;
modifying the identified subset of the plurality of n-dimensional simplices to adapt said first finite element mesh such that it comprises said second finite element mesh and a third finite element mesh, wherein said second finite element mesh comprises a first set of simplices located entirely interior to said surface and wherein said third finite element mesh comprises a second set of simplices located entirely exterior to said surface; and
displaying said first finite element mesh in said computer graphical user interface.

2. (Previously Presented) The computer-implemented method of Claim 1, wherein modifying said identified subset of said plurality of n-dimensional simplices further comprises subdividing each of said simplices in said identified subset into a plurality of new simplices, and wherein a plurality of faces of said subdivided simplices are substantially coincident with said surface.

3. (Previously Presented) The computer-implemented method of Claim 1, wherein modifying said identified subset of the plurality of n-dimensional simplices comprises collapsing each of said simplices in said identified subset.

4. (Previously Presented) The computer-implemented method of Claim 3, wherein each of said n-dimensional simplices has a plurality of nodes and a plurality of edges connecting said nodes, wherein at least one of said nodes is invariant and wherein collapsing each of said simplices in said identified subset comprises removing one or more of said nodes, preventing removal of the invariant nodes, and forming simplices based upon the remaining nodes.

5. (Previously Presented) The computer-implemented method of Claim 1, wherein said first and said second systems are three-dimensional systems, wherein n=3, and wherein said surface is an (n-1)-dimensional surface.

6. (Previously Presented) The computer-implemented method of Claim 5, wherein said (n-1)-dimensional surface corresponds to a well bore surface, and wherein said (n-1)-dimensional surface is defined by a depth along a well bore trajectory and a radius from said well bore trajectory.

7. (Previously Presented) The computer-implemented method of Claim 1, wherein said first system is a reservoir.

8. (Previously Presented) The computer-implemented method of Claim 1, wherein said second system is a well bore.

9. (Canceled).

10. (Previously Presented) The computer-implemented method of Claim 1, wherein said step of constructing said first mesh is performed using a mesh generation algorithm.

11. (Previously Presented) The computer-implemented method of Claim 10, wherein said mesh generation algorithm is an Inria meshing algorithm.

12. (Previously Presented) The computer-implemented method of Claim 1, wherein each of the n-dimensional simplices in said identified subset of the plurality of n-dimensional simplices is intersected by an (n-1)-dimensional surface.

13. (Previously Presented) The computer-implemented method of Claim 12, wherein the (n-1)-dimensional surface intersects at least one edge of each of the n-dimensional simplices in the identified subset of the plurality of n-dimensional simplices.

14. (Previously Presented) The computer-implemented method of Claim 1, wherein each of said n-dimensional simplices has a plurality of nodes and a plurality of edges connecting said nodes, and wherein the method further comprises identifying intersections between the edges of said subset of simplices and said surface, defining a new node at each of said identified intersections, and defining at least two new simplices incorporating said new nodes.

15. (Previously Presented) The computer-implemented method of Claim 1, wherein said first system comprises a multi-level reservoir.

16. (Previously Presented) The computer-implemented method of Claim 1, further comprising the step of altering the value of system properties in said second mesh and in said third mesh near said second mesh to predict changes in system behavior for said second system.

17. (Previously Presented) The computer-implemented method of Claim 1, wherein said method steps are performed on a computer.

18. (Previously Presented) The computer-implemented method of Claim 17, wherein said computer comprises a graphical user interface for inputting user instructions and parameter values.

19. (Previously Presented) A computer-readable medium containing a plurality of computer-implementable instructions embodying a method for constructing a second finite element mesh within a first finite element mesh to model a second system within a first system modeled by said first mesh, said method comprising:

constructing said first mesh having a plurality of n-dimensional simplices corresponding to said first system;

defining a surface bounding said second system;

identifying a subset of the plurality of n-dimensional simplices of said first mesh that are intersected by said surface; and

modifying the identified subset of the plurality of n-dimensional simplices to adapt said first mesh such that it comprises said second mesh and a third mesh, wherein said second mesh comprises a first set of simplices located entirely interior to said surface and wherein said third mesh comprises a second set of simplices located entirely exterior to said surface.

20. (Original) The computer-readable medium of Claim 19, wherein said modifying step of said method further comprises subdividing each of said simplices in said identified subset into a plurality of new simplices, and wherein a plurality of faces of said subdivided simplices are substantially coincident with said surface.

21. (Original) The computer-readable medium of Claim 19, wherein said first and said second systems are three-dimensional systems, wherein n=3, and wherein said surface is an (n-1)-dimensional surface.

22. (Original) The computer-readable medium of Claim 21, wherein said (n-1)-dimensional surface corresponds to a well bore surface, and wherein said (n-1)-dimensional surface is defined by a depth along a well bore trajectory and a radius from said well bore trajectory.

23. (Original) The computer-readable medium of Claim 19, wherein said first system is a reservoir.

24. (Original) The computer-readable medium of Claim 19, wherein said second system is a well bore.

25. (Original) The computer-readable medium of Claim 19, wherein said defining step of said method further comprises providing a well bore trajectory, a radius from said trajectory, and a depth along said trajectory.

26. (Original) The computer-readable medium of Claim 19, wherein said step of constructing said first mesh of said method is performed using a mesh generation algorithm.

27. (Previously Presented) The computer-readable medium of Claim 26, wherein said mesh generation algorithm is an Inria meshing algorithm.

28. (Original) The computer-readable medium of Claim 19, wherein each of the n-dimensional simplices in said identified subset of the plurality of n-dimensional simplices is intersected by an (n-1)-dimensional surface.

29. (Original) The computer-readable medium of Claim 28, wherein the (n-1)-dimensional surface intersects at least one edge of each of said n-dimensional simplices in said identified subset of said plurality of n-dimensional simplices.

30. (Original) The computer-readable medium of Claim 19, wherein each of said n-dimensional simplices has a plurality of nodes and a plurality of edges connecting said nodes, and wherein said method further comprises identifying intersections between the edges of said subset of simplices and said surface, defining a new node at each of said identified intersections, and defining at least two new simplices incorporating said new nodes.

31. (Original) The computer-readable medium of Claim 19, wherein said first system comprises a multi-level reservoir.

32. (Original) The computer-readable medium of Claim 19, wherein said method further comprises the step of altering the value of system properties in said second mesh and in said third mesh near said second mesh to predict changes in system behavior for said second system.

33. – 50. (Canceled)